Ocean Engineering Technical Data Sheet
Carmanah 700-series LED Lantern

The Carmanah 700-series lanterns are self-powered, omni-directional LED lanterns. This document provides performance data (Section 1), selection criteria (Section 2), set-up, installation and maintenance instructions (Section 3), and ordering information (Section 4).

Overview

The Carmanah 700-series lanterns are manufactured by Carmanah Technologies Inc., Building 4, 203 Harbour Road, Victoria, British Columbia, Canada V9A 3S2, phone: Website: http://www.carmanah.com/ .

The lanterns are self-contained; the solar panels, battery, flasher, daylight control and lantern assembly are housed as a single unit. They are available in three models: the 701, 702 and 702-5. All three models produce the same intensity; the difference is the size of the solar panels and internal battery. The 701 has the least capable power system; the 702-5 has the most capable power system.

Every lantern has an inherent color (red, green, white or yellow), but the flash rhythms are programmable.

Carmanah 700-Series LED Lantern

701 702 702-5

CARMANAH 700-SERIES LED LANTERN
SECTION 1
PERFORMANCE DATA

Intensity

The red, green, white and yellow-colored Carmanah 700-series lanterns all have the same intensity for a given flash characteristic. A somewhat unique characteristic of these lanterns is that the power to the LEDs is reduced for duty cycles over 25%. This is done to save power.

The following table shows effective intensities of Carmanah lanterns for the standard buoy flash characteristics. For comparison, the table also shows the corresponding effective intensities of 155mm lanterns, with 0.55 amp lamps, in red, green and white.

EFFECTIVE INTENSITIES OF CARMANAH 700-SERIES LANTERN

(and 155mm lantern with 0.55 amp lamps – all values in candela)

Characteristic	Carmanah	155mm – red	155mm – green	155 – white
FL 2.5 (0.3)	15	20	20	60
FL 4	17	20	25	70
FL 6	19	25	30	85
FL (2) 5	17	20	25	70
FL (2+1) 6	15	20	20	60
Mo(A)	14	--	--	70
Q	13	20	20	60

Vertical Divergence

Vertical divergence (degrees)	**Red**	**Green**
50% beam width	±2.8	±3.5
15% beam width	±8.9	±9.5

CARMANAH 700-SERIES LED LANTERN
SECTION 2
SELECTION

Overview

The 700-series Carmanah is authorized for use on the modified 5th class foam buoy. This buoy/lantern combination is a replacement for the old lighted discrepancy buoy, which will be discontinued. Use on other platforms and AtoN stations is permitted at the discretion of district aids to navigation offices.

District Considerations - Intensity

Replacing a 155mm with a Carmanah will result in a decrease in intensity, and therefore a reduction in service to the mariner. It is important that Districts carefully evaluate the reduction in intensity prior to authorizing a change. This is particularly important for white and yellow lights because of the very large intensity differences between Carmanah and 155mm lanterns for these colors.

To determine the intensity requirements for any aid, Districts use the standard procedures for selecting an AtoN light signal as prescribed in the AtoN Technical Manual (Chapter 6, Section 6.B, page 6-1) and the Visual Signal Design Manual (Chapter 3). These references describe how operational range, luminous range, light color, light characteristic, background lighting, and meteorological visibility are used to calculate intensity needs.

Selecting a Specific Carmanah Model

If, and only if the District has determined that a Carmanah will provide an intensity that meets the operational needs for a specific aid, **then** the next step is to choose a Carmanah model that has a power system matched to the aid location and flash characteristic. The table that begins on the following page should be used to select a Carmanah model. The table uses the same 92 solar radiation reference sites as the existing USCG solar sizing table. Note that the green lanterns are sized differently than the red, white or amber (yellow). Note also that some location/flash-characteristic combinations have an "N/A" (particularly in Districts 13 and 17). "N/A" means that no Carmanah model can be used because the power system cannot power the aid with the available solar radiation.

Carmanah Solar Sizing Table

(page 1)

Color:	Green	Red White Yellow	Green	Red White Yellow	Green	Red White	Green	Red White Yellow
Characteristic:	**FL 4 FL 6**	**FL 4 FL 6**	**FL 2.5 (0.3s)**	**FL 2.5 (0.3s)**	**FL(2+1)6**	**FL(2+1)6 FL (2) 5**	**Q**	**Q Mo (A)**
Portland, ME	701	701	701	702	701	702	702	702-5
Boston, MA	701	701	701	702	701	702	702	702-5
Providence, RI	701	701	701	702	701	702	702	702-5
Bridgeport, CT	701	701	701	702	701	702	702	702-5
New York, NY	701	701	701	702	701	702	702	702-5
Albany, NY	701	701	701	702	701	702	702	**N/A**
Burlington, VT	701	701	701	702	701	702	702	**N/A**
Newark, NJ	701	701	701	702	701	702	702	702-5
Atlantic City, NJ	701	701	701	701	701	702	702	702
Wilmington, DE	701	701	701	701	701	702	702	702
Philadelphia, PA	701	701	701	701	701	702	702	702
Baltimore, MD	701	701	701	701	701	702	702	702
Sterling, VA	701	701	701	701	701	702	702	702
Norfolk, VA	701	701	701	701	701	702	702	702
Cape Hatteras, NC	701	701	701	701	701	701	701	702
Wilmington, NC	701	701	701	701	701	701	701	702
Charleston, SC	701	701	701	701	701	701	701	702
Savannah, GA	701	701	701	701	701	701	701	702
Jacksonville, FL	701	701	701	701	701	701	701	702
Daytona Beach, FL	701	701	701	701	701	701	701	702
West Palm Beach, FL	701	701	701	701	701	701	701	702
Miami, FL	701	701	701	701	701	701	701	702
San Juan, PR	701	701	701	701	701	701	701	702
Key West, FL	701	701	701	701	701	701	701	702
Tampa, FL	701	701	701	701	701	701	701	702
Tallahassee, FL	701	701	701	701	701	701	701	702
Mobile, AL	701	701	701	701	701	701	701	702
New Orleans, LA	701	701	701	701	701	701	701	702
Port Arthur, TX	701	701	701	701	701	701	701	702
Houston, TX	701	701	701	701	701	701	701	702
Corpus Christi, TX	701	701	701	701	701	701	701	702
Brownsville, TX	701	701	701	701	701	701	701	702
Little Rock, AR	701	701	701	701	701	702	701	702
Fort Smith, AR	701	701	701	701	701	701	701	702

Notes:
1. Numbers in table refer to Carmanah Model number.
2. "N/A" means that no Carmanah can provide the desired characteristic.
3. If a desired characteristic is not listed contact Ocean Engineering (G-SEC-2).
4. Contact Ocean Engineering for sizing information for seasonal aids.

Carmanah Solar Sizing Table

(page 2)

Color:	Green	Red White Yellow	Green	Red White Yellow	Green	Red White	Green	Red White Yellow
Characteristic:	**FL 4 FL 6**	**FL 4 FL 6**	**FL 2.5 (0.3s)**	**FL 2.5 (0.3s)**	**FL(2+1)6**	**FL(2+1)6 FL (2) 5**	**Q**	**Q Mo (A)**
Oklahoma City, OK	701	701	701	701	701	701	701	702
Memphis, TN	701	701	701	701	701	702	702	702
Huntsville, AL	701	701	701	701	701	702	702	702
Chattanooga, TN	701	701	701	701	701	702	702	702
St Louis, MO	701	701	701	701	701	702	702	702
Kansas City, MO	701	701	701	701	701	702	702	702
Moline, IL	701	701	701	702	701	702	702	702-5
Minneapolis, MN	701	701	701	702	701	702	702	**N/A**
Evansville, IN	701	701	701	701	701	702	702	702
Indianapolis, IN	701	701	701	702	701	702	702	702-5
Louisville, KY	701	701	701	702	701	702	702	702-5
Cincinnati, OH	701	701	701	702	701	702	702	702-5
Pittsburgh, PA	701	702	701	702	701	702	702	**N/A**
Massena, NY	701	702	701	702	701	702	702	**N/A**
Rochester, NY	701	702	701	702	702	702	702	**N/A**
Buffalo, NY	701	702	701	702	702	702	702	**N/A**
Erie, PA	701	702	701	702	702	702	702	**N/A**
Cleveland, OH	701	702	701	702	702	702	702	**N/A**
Toledo, OH	701	702	701	702	701	702	702	**N/A**
Detroit, MI	701	702	701	702	702	702	702	**N/A**
Alpena, MI	701	702	701	702	702	702	702	**N/A**
Traverse City, MI	701	702	701	702	702	702	702	**N/A**
Muskegon, MI	701	702	701	702	702	702	702	**N/A**
Chicago, IL	701	702	701	702	701	702	702	**N/A**
Milwaukee, WI	701	702	701	702	701	702	702	**N/A**
Green Bay, WI	701	701	701	702	701	702	702	**N/A**
Sault Ste Marie, MI	701	702	701	702	702	702	702	**N/A**
Houghton, MI	701	702	702	702	702	702-5	702-5	**N/A**
Duluth, MN	701	702	701	702	701	702	702	**N/A**
Internat'l Falls, MN	701	702	701	702	702	702	702	**N/A**
Salt Lake City, UT	701	701	701	702	701	702	702	702-5
Reno, NV	701	701	701	701	701	702	701	702
Las Vegas, NV	701	701	701	701	701	701	701	702
San Diego, CA	701	701	701	701	701	701	701	702

Notes:
1. Numbers in table refer to Carmanah Model number.
2. "N/A" means that no Carmanah can provide the desired characteristic.
3. If a desired characteristic is not listed contact Ocean Engineering (G-SEC-2).
4. Contact Ocean Engineering for sizing information for seasonal aids.

Carmanah Solar Sizing Table

(page 3)

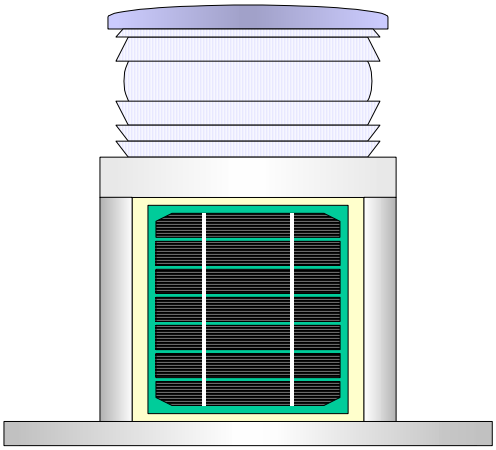
Color:	Green	Red White Yellow	Green	Red White Yellow	Green	Red White	Green	Red White Yellow
Characteristic:	**FL 4 FL 6**	**FL 4 FL 6**	**FL 2.5 (0.3s)**	**FL 2.5 (0.3s)**	**FL(2+1)6**	**FL(2+1)6 FL (2) 5**	**Q**	**Q Mo (A)**
Long Beach, CA	701	701	701	701	701	701	701	702
Los Angeles, CA	701	701	701	701	701	701	701	702
Santa Maria, CA	701	701	701	701	701	701	701	702
San Francisco, CA	701	701	701	701	701	702	702	702
Arcata, CA	701	701	701	702	701	702	702	702-5
North Bend, OR	701	702	701	702	701	702	702	**N/A**
Astoria, OR	701	702	702	702	702	**N/A**	702-5	**N/A**
Portland, OR	701	702	702	702	702	**N/A**	**N/A**	**N/A**
Pendleton, OR	701	702	701	702	702	702	702	**N/A**
Quillayute, WA	701	702	702	702	702	**N/A**	**N/A**	**N/A**
Seattle, WA	701	702	702	702	702	**N/A**	**N/A**	**N/A**
Annette, AK	702	**N/A**	702	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Yakutat, AK	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Anchorage, AK	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Kodiak, AK	702	**N/A**	702	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Cold Bay, AK	702	**N/A**	702	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
King Salmon, AK	702	**N/A**	702-5	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Bethel, AK	702-5	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Nome, AK	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Hilo, HI	701	701	701	701	701	701	701	702
Kahului, HI	701	701	701	701	701	701	701	702
Honolulu, HI	701	701	701	701	701	701	701	702
Lihue, HI	701	701	701	701	701	701	701	702
Guam	701	701	701	701	701	701	701	702

Notes:
1. Numbers in table refer to Carmanah Model number.
2. "N/A" means that no Carmanah can provide the desired characteristic.
3. If a desired characteristic is not listed contact Ocean Engineering (G-SEC-2).
4. Contact Ocean Engineering for sizing information for seasonal aids.

Nominal Range

The nominal range of the 700-series lanterns is 3 nautical miles. This is the value that should be published in the Light List. **Caution:** as stated in the AtoN Technical Manual, "The nominal range of a light plays no part in the selection process." Never select a lantern for an aid based on the lantern's nominal range.

CARMANAH 700-SERIES LED LANTERN
SECTION 3
SET-UP, INSTALLATION AND MAINTENANCE



Storage and Charging

The lanterns are charged prior to shipment. It will arrive fully charged and programmed OFF, (i.e., it will not flash in a darkened room) and ALC* feature disabled. You will need an IR programmer to turn the lantern on and to program it to a desired flash pattern.

The batteries are very susceptible to self-discharge, especially if left unused in a very warm place for a long period of time. To avoid this unnecessary loss of charge and battery damage, store the lantern at 20°C (68°F) or cooler. If this is not possible, the lanterns (batteries) will have to be recharged at the following charge intervals to preserve the battery:

Storage Temperature [°F/°C]	Recharge Interval for 700 Series Lanterns [months]
68-95 (20-35)	6
95-104/35-40	3
More than 104/40	1

For example, if a 700 series lantern is stored at 100°F, it will have to be charged every 3 months in order to preserve the battery.

*The Automatic Light Control is not used on USCG aids to navigation.

The following are some recommendations on different ways to charge the lantern:

Lantern Model	Light Source	Distance from Solar Panel	Hours to Charge Battery from 10% to 100%
701	500 W halogen spot	2 feet	300
	60 W tungsten in a reflector housing (desk lamp)	2 inches	
	Direct sunlight (should be turned off)	Perpendicular to Solar Panels	75
702	500 W halogen spot	2 feet	250
	60 W tungsten in a reflector housing (desk lamp)	2 inches	
	Direct sunlight (should be turned off)	Perpendicular to Solar Panels	62.5

Applying light to more than one solar panel at the same time can reduce the amount of time to charge 701/702 lanterns, e.g., four lights on four panels would divide charging time by four.

Warning: reduction of the distance will overheat the solar panel; increasing the distance greatly reduces the charging efficiency.

An alternative is to purchase an external charger from Carmanah and the access tool for the tamper resistant Allen screw (see the GSA contract information in Section 4); the 5/32" tamper resistant Allen wrench may be purchased from Carmanah or McMaster Carr Supply Company, 732-329-3200, part number 7390A27). The charger will recharge the battery in a fraction of the time, however specific procedures must be followed or damage to the battery and/or control unit will occur.

1. Place security bit in a hex-driver or drill and remove the top four screws from housing completely. Remove nylon washers from each of the holes in the flange. Discard both.
2. Gently pull up on one corner of the flange. Use caution as the head unit may stick due to the gasket being compressed onto the housing body.
3. Once the head has been separated, disconnect the 3-conductor (black and red) cable first, by depressing the catch on the clip and gently pulling apart. Be sure not to pull on the wires; grasp only the clip.
4. Disconnect the 2-conductor (orange and black) cable in the same manner as described above.
5. Remove the small desiccant pack from inside the light and discard.
6. Remove and retain the foam-packing block.

7. Take the battery pack out of the housing.
8. Attach the proper external charger pigtail to the connector feeding the battery.
9. Measure the voltage at the point where wires from the battery connector are soldered to the battery board. Ensure that the voltmeter probes do not touch each other when making a measurement.
10. Based on the voltage measurement, charge the battery in a well ventilated area for the following amount of time:

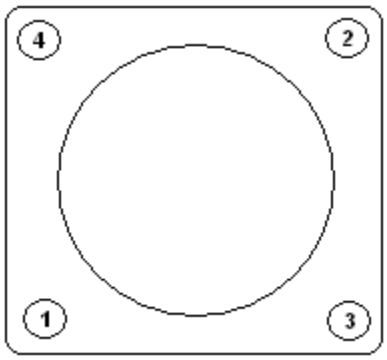
Voltage	701 Lantern (15 amp-hours)	702 & 702-5 Lanterns (24 amp-hours)
4.14 volts or higher	5 hours	7 hours
3.98 volts to 4.13 volts	15 hours	18 hours
3.86 volts or lower	20 hours	27 hours

Do not charge the battery longer than the time specified.
Overcharging can cause hydrogen gas to vent, which can consequently reduce the battery life.

Make sure that the plugs on the charger do not touch each other if you have the old style of the charger with banana plugs. 

11. Using a paper towel or cloth with a small amount of rubbing alcohol, wipe the top edge of the housing extrusion where it comes into contact with the head gasket. This will help ensure a proper seal.
12. Pull the gasket on the underside of the head out of its channel. Discard gasket.
13. Install the new gasket by pressing it into place. Be sure it is evenly seated in the channel. DO NOT USE TOOLS. USE YOUR FINGERS ONLY.
14. Reinstall the foam-packing block and a new desiccant bag (if available).
15. Place the optic head next to the base and connect the orange and black cable first. The light should begin flashing. The light will retain the last flash pattern programmed.
16. Connect the black and red cable.
17. Place the head into position on top of the housing. ENSURE THAT THE CABLING DOES NOT PROTRUDE OUTSIDE THE HOUSING! IF IT DOES IT WILL BE PINCHED AND CUT BY THE FLANGE WHEN IT IS BEING TIGHTENED. Tuck it in with your finger or a blunt tool.
18. Place a new nylon washer into each hole recess.
19. Using an anti-seize paste (Permatex or equivalent), lightly coat the threads of the new screws and insert them into the mounting holes as far as you can, using your fingers. This will help avoid the chance of cross threading.

20. Using the security bit, tighten the head down in the following order:



21. Tighten the screws firmly by hand to slightly compress the gasket. Over tightening may damage the threads in the aluminum base.

Programming

The color of the lantern cannot be identified by the appearance of the lens or LEDs when they are off. The color of the lantern is indicated by the color of the ring around the lens.

An LED lantern-programming shroud, (essentially a wrap that covers the solar panels but leaves the lens area open for programming and visual confirmation of the flash rhythm) may be fabricated from any opaque material. This cover is necessary to check the daylight control function of the Carmanah LED lantern after installation and should be used to program the proper flash rhythm before initial deployment. Programming is accomplished with a TV remote control set to communicate with the lantern. The remote can be purchased from Carmanah or a "One for ALL" universal remote from Wal-Mart. If the lantern does not respond to the controller, or if the batteries are removed, reprogram the Carmanah controller by pressing CODE SEARCH until the red light comes on, then the TV button, then enter 0 0 6. The Wal-Mart controller must be programmed by pressing the TV button until the red light blinks once, then press and hold the setup button until the red light on the controller blinks twice. Release and press the setup button, then the 4 digit setup code 0-0-5-6, the light will blink two more times to let you know that it has accepted the code.

Programming is accomplished after the lantern changes from day/night or night/day. It is preferable, but not necessary to program the lantern in the night mode, out of direct sunlight and strong indoor lights. Lanterns produced after 1 January 2004 have improved hardware and software that are much more receptive to the programmer.

If stored in a brightly lit area, cover the lantern by placing the shroud around the solar panels, and the top solar panel (702-5 only). If stored in a dark area, move to a brightly lit area and wait 2 minutes, then cover the lantern, as described above. If the lantern was stored in the off mode, it will not come on by itself; the programmer will have to be used to program a flash rhythm. If the

lantern was left in storage without shutting it off, it will come on at this point and start flashing with the last programmed rhythm. If the lantern does not respond to programming, move the lantern from dark to light and light to dark a few times to "wake up" the processor.

NOTE: Fluorescent lighting may not allow the lantern to transition from night to day. Suggest that incandescent lighting be used, or if possible outdoor lighting. Also, to simulate nighttime, the shipping container with a slot cut in it to allow programming can be placed over top of the lantern to block out unwanted light, as shown in Figure 1:

Figure 1.

Programming must be started within 1 minute. The lantern responds after each entry with a 1/4-second flash. A double flash means it did not recognized the entry. Reenter that key until the correct confirmation is displayed.

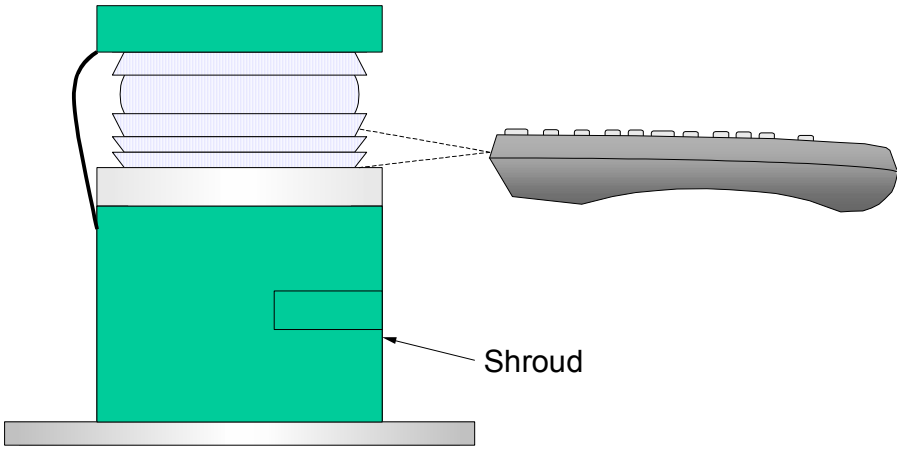


Figure 2.

- **Aim the controller at the lower portion of the lens, as shown in Figure 2.**

- **Enter the security code**: POWER, 7 5 3, CHAN^. After CHAN^ a flash followed by a very quick flash indicates successful entry of the security code. On lanterns produced after 1 Jan 04, the single conformation flash after CHAN^ is followed by 3 quick flashes indicating that the security code was entered correctly.

- **Enter the desired rhythm**: POWER, # # #, CHAN^. On lanterns shipped after 1 Jan 04, the sequence is followed by 3 quick flashes. If the solar panels are covered, or the lantern is in a dark room, the lantern should start flashing on rhythm:

  The following codes refer to our standard rhythms. More rhythms are detailed in the instruction manual supplied with the lantern.

FL 2.5 (0.3s)	**049**	FL (2+1)	**022**
FL 4	**174**	Q	**129**
FL 6	**073**	Mo(A)	**176**
FL (2) 5	**175**	OFF (for storage)	**000**

Check the rhythm with your watch and bench test for 8-24 hours with the shroud on (the lantern will turn off automatically if left flashing for longer than 24 hours, but will turn back on after deployment). If the beacon will not be deployed within 1-2 days, then remove the shroud and store outside in the sun or program the lantern to OFF, as described above.

Installation

The lantern may be installed on modified 5th class lighted foam buoys, structures, and steel buoys where the operational range requirements are met for the specific color and flash rhythm (see Section 2). Three bolts protruding from the top-plate of the buoy or three leveling studs on structures are used to secure the lantern. However, the bolts will shadow the solar panels if they extend too far. Therefore, install three nuts on the bolts (similar to installing a lantern on a structure) so that about 1" of thread is exposed. Be sure that the nuts are the same distance from the top-plate so that the lantern is "level" on the buoy. On structures, place a torpedo level on the base plate of the lantern. Adjust the leveling studs so that lantern is level in two directions. Use the "T" method described in the Short Range Aids to Navigation Servicing Guide COMDTINST M16500.19A.

Be sure the lantern is properly programmed prior to installation. Install the lantern on the bolts and secure with a lock washer and nut, as shown in Figure 3. 701 & 702 lanterns purchased after 1 Jan 04 have an optional bird spike (earlier lanterns can not be retrofitted). Screw the bird spike into the top of the lantern and secure with Vise Grips until it is tight. There is a clamp-on bird spike available for lanterns purchased prior to 1 Jan 04. Contact Carmanah for details.

If the lantern is installed directly on the top-plate of a steel buoy with bolts facing down (to minimize the protrusion), install an insulating nylon washer on each bolt between the lantern and top-plate to prevent crevice corrosion.

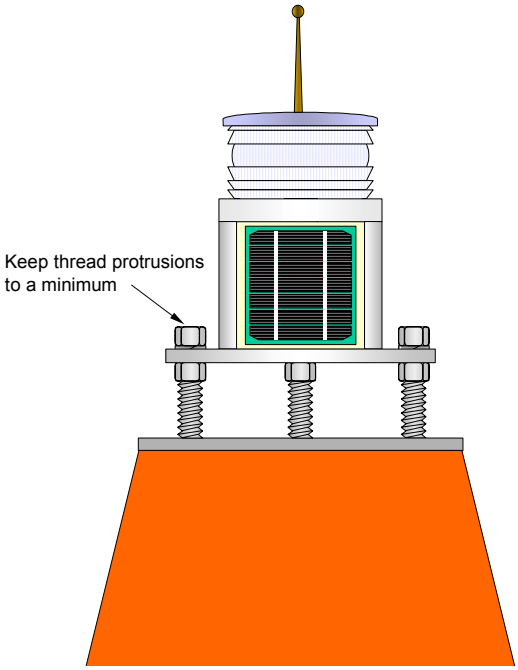


Figure 3.

Service Life

LED lanterns generally do not burn out, but light output degrades over time to a point that the light may not meet the operational range. Therefore lanterns shall be removed from service according to the following schedule:

Duty Cycle	Service Life (nighttime operation)
10% to 29%	12 years
30%-100%	8 years

Although overall battery life is yet to be determined through field trials, schedule replacement of the battery pack to coincide with the service life of the lantern, not to exceed 4 years. For example, a **FL6(.6)** rhythm has a 10% duty and a service life of 12 years. Schedule replacement of the battery pack at 4-year intervals.

Servicing

Servicing should be performed in accordance with the standard cycle established for the aid.

Ensure that the lens and solar panels are clean. Wipe with a cloth dampened with mild soap and water, if necessary.

Cover the lantern with a shroud, jacket, box, blanket, etc., to simulate darkness. The lantern should flash on rhythm after a few seconds. It should stop flashing after the cover is removed in the daytime. While covered, observe the LEDs through the lens. Dark sectors indicate that an LED cluster is not operating, necessitating replacement of the optic head. Contact Carmanah for replacement assemblies as there is a 3-year prorated warranty on all lanterns.

Troubleshooting

Lantern will not respond or will not accept codes:

- Transition the lantern from light to dark a few times to "wake" up the lantern. Try to program in a room with subdued lighting. Lanterns produced after 1 Jan 2004 are more responsive to programming functions.
- Reset the lantern by entering the following codes:
    - Transition the lantern from light to dark or vice-versa.
    - **Enter the security code**: POWER, 7 5 3, CHAN^.
    - **Enter code 911:** POWER, 9 1 1, CHAN^. 9 1 1 is intended to clear the memory of all previously entered codes, and to introduce a known, cleared state. If the light is transitioned and not cleared of its OFF code, it will turn itself off again due to the instruction it has in memory.
    - **Enter the security code again**: POWER, 7 5 3, CHAN^.
    - **Enter code 800**: POWER, 8,0,0, Chan^. 8 0 0 turns off ALC (Automatic Light Control). This prevents the lantern from operating intermittently if a low battery condition is present and maintains full intensity until complete failure.
    - **Enter the desired rhythm**: POWER, # # #, CHAN^.
- If reprogramming is unsuccessful, open the lantern using the appropriate tools and charge the battery, as discussed in the charging section. If the battery voltage does not recover, then replace the battery pack. If the lantern still fails to operate, either replace the lantern or optic head.

Lantern reported discrepant

- Determine the battery's state of charge by entering the following codes:
    - Transition the lantern from light to dark or vice-versa.
    - **Enter the security code**: POWER, 7 5 3, CHAN^.
    - **Enter code 810.** Count the number of flashes in the first set, and then check your count during the second set. The number will correspond to the battery's state of charge
      Up until December 31, 2003, the lantern will emit two sets of relatively quick flashes indicating battery charge. The full state charge is indicated with a minimum of 9 flashes while the 10% charge is indicated with 3 flashes.
      After 1 Jan 04 will emit three quick flashes, then two sets of slower flashes where 1 flash is 10% and 10 flashes is 100%,

      If the state of charge is below 50%, replace the battery and consult Carmanah to determine if a larger lantern is required for that location.

- **If the light is non-responsive, see the section above for procedures.**

- If the light is flashing briefly once a minute, it is in the low battery and needs to be charge. Follow the charging procedures on pages 1 through 4 of this Section.

CARMANAH 700-SERIES LED LANTERN
SECTION 4
ORDERING INSTRUCTIONS

700 Series LED Lanterns are manufactured by Carmanah Technologies Inc., Building 4, 203 Harbour Road, Victoria, British Columbia, Canada V9A 3S2, phone: (877) 722-8877, Website: http://www.carmanah.com. Lanterns may be purchased on-line or by phone using a Government credit card. The buyer specifies the Model Number (701, 702, or 702-5) as determined by using the Carmanah Solar Sizing Table as described in Section 2 of this Technical Data Sheet. The buyer specifies the color (red, green, white or yellow), but not the flash rhythm; depending on the intended location, the rhythm is programmed by the CG unit. An optional bird spike may be purchased for 701 and 702 lanterns for an additional $15.00 (specify when ordering). The new bird spike cannot be retrofitted on existing lanterns, however a clamp-on version is now available from Carmanah.

Coast Guard units should buy Carmanah products using a General Services Administration (GSA) contract. Details of the contract, including prices and ordering information can be found on the following 4 pages.

Standard Form 1449, Contract for Commercial Items Page lB
Carmanah Technologies Inc.
Contract Number GS-07F-0513M

GENERAL SERVICES ADMINISTRATION
FEDERAL SUPPLY SERVICE
AUTHORIZED FEDERAL SUPPLY SCHEDULE CATALOG/PRICE LIST

On-line access to contract ordering information, terms and conditions, up-to-date pricing, and the option to create an electronic delivery order is available through GSA *Advantage!,* a menu-driven database system. The INTERNET address for GSA *Advantage!* is http://www.gsa.gov.)

SCHEDULE TITLE: FSC 62, Attachment #11 – Solar Energy Systems, Energy Efficient and Specialty Lighting Products

FSC CLASS (ES): 6117

CONTRACT NUMBER: GS-07F-0513M

CONTRACT PERIOD: 9/4/02 through 9/3/07

CONTRACTOR'S NAME, ADDRESS, TELEPHONE AND FAX NUMBER; E-MAIL AND/OR WEB SITE ADDRESS:

Carmanah Technologies Inc.
Building 4
203 Harbour Road
Victoria, British Columbia, CN V9A 3S2

Telephone: 250-380-0052
Fax: 250-380-0062

CONTRACTOR'S ADMINISTRATION SOURCE: Irene Schamhart and Darren Webb

BUSINESS SIZE/TYPE: Small Foreign Manufacturer

INFORMATION FOR ORDERING ACTIVITIES:

1a. TABLE OF AWARDED SPECIAL ITEM NUMBERS (SIN's)

SIN	DESCRIPTION
206-3	Solar Energy Systems

lb. LOWEST PRICED MODEL NUMBER AND PRICE FOR EACH SIN:
(Government net price based on a unit of one)

SIN	MODEL	PRICE

206-3 * *

Standard Form 1449, Contract for Commercial Items (Cont'd) Page 1C
Carmanah Technologies Inc.
Contract Number GS-07F-0513M

2. MAXIMUM ORDER PER SIN: $75,000*

*If the "best value" selection places your order over this Maximum Order, you have an opportunity to obtain a better schedule contract price. Before placing your order, contact the aforementioned contractor for a better price. The contractor may (1) offer a new price for this requirement (2) offer the lowest price available under this contract or (3) decline the order. A delivery order that exceeds the maximum order may be placed under the Schedule contract in accordance with FAR 8.404.

3. MINIMUM ORDER: $100 unless the contractor agrees to accept a smaller order amount.

4. GEOGRAPHIC COVERAGE: The 50 United States, Puerto Rico, and Washington, D.C

5. POINT(S) OF PRODUCTION: Same as contractor's address

6. BASIC DISCOUNT: 25% off Carmanah Price List dated July 2002

7. QUANTITY DISCOUNT (5): None

8. PROMPT PAYMENT TERMS: Net 30 Days

9. TYPE OF GOVERNMENT PURCHASE CARD ACCEPTED: All major credit cards

10. FOREIGN ITEMS: None

1la. TIME OF DELIVERY: 14 Days ARO

1lb. EXPEDITED DELIVERY: Please call for telephone confirmation of availability.

11c. OVERNIGHT AND 2-DAY DELIVERY: Same as 1lb.

11d. URGENT DELIVERY: When the delivery period above does not meet the customer's bona fide urgent delivery requirements, customers are encouraged, if time permits, to contact the contractor for the purpose of requesting accelerated delivery. The contractor shall reply within 3 workdays after receipt. (Telephonic replies shall be confirmed by the contractor in writing.) If the contractor offers an accelerated delivery time acceptable to the customer, any orders placed pursuant to the agreed upon accelerated delivery time frame shall be delivered within this shorter delivery time and in accordance with all other terms and conditions of the contract.

12. FOB POINT: Origin

13. ORDERING ADDRESS: Same as Contractor's Address

14. PAYMENT ADDRESS: Same as Contractor's Address

15. WARRANTY: Standard Commercial 3 year limited Product Warranty

16. EXPORT PACKING CHARGES: Not applicable

17. TERMS AND CONDITIONS OF GOVERNMENT PURCHASE CARD ACCEPTANCE: Contractor will accept Government Purchase Card for orders of $2,500 or less. Contact contractor for acceptance of larger orders.

18. TERMS AND CONDITIONS OF RENTAL, MAINTENANCE, AND REPAIR (IF APPLICABLE):

19. TERMS AND CONDITIONS OF INSTALLATION (IF APPLICABLE):

20a. TERMS AND CONDITIONS OF REPAIR PARTS INDICATING DATE OF PARTS PRICE LISTS AND ANY DISCOUNTS FROM LIST PRICES (IF AVAILABLE):

20b. TERMS AND CONDITIONS FOR ANY OTHER SERVICES (IF APPLICABLE):

21. LIST OF SERVICE AND DISTRIBUTION POINTS (IF APPLICABLE):

22. LIST OF PARTICIPATING DEALERS (IF APPLICABLE):

23. PREVENTIVE MAINTENANCE (IF APPLICABLE):

24. ENVIRONMENTAL ATTRIBUTES (e.g. RECYCLED CONTENT, ENERGY EFFICIENCY, AND/OR REDUCED POLLUTANTS): *

July 2002

Carmanah

Price List

Products		List Price	(US Dollars) GSA Contract Price
Model 601		$349.00	$261.75
Model 701		$999.00	$749.25
Model 702		$1,199.00	$899.25
Model 702-5		$1,249.00	$936.75
30404	Bird Spike for 701 & 702 lanterns	$21.95	$15.00 extra
35896	Clamp-on Bird Spike for older 701 & 702	$21.95	$15.00
30797	External Battery Charger	$199.00	$89.00
FG10676	IR Remote Control	$34.95	$29.00
Kit-015	Head/Battery Replacement Gasket Kit	$14.25	$9.95
30567	Tamper Resistant Tool	$6.65	$4.99
Kit-007	Battery Replacement (702)	$199.00	$119.40
Kit-006	Battery Replacement (701)	$149.00	$89.40
------	701 Head Replacement	$443.75	$332.81

For US Coast Guard units: To obtain the GSA price, contact Mimi Drabit at 877-722-8877, ext 225.

All prices are in U.S. dollars.
Payment terms: Prepayment by Visa, MasterCard, bank draft or wire transfer.
Prices do not include shipping, freight insurance or applicable taxes and duties.
Carmanah products are covered by a three-year warranty.
Please visit http://www.carmanah.com/warranty.html for complete details.

Carmanah Technologies Inc. Building 4, 203 Harbour Rd., Victoria, British Columbia. Canada V9A 352
Toll-free: (877) 722-8877; General: (250) 380-0052; Fax: (250) 380-0062
E-mail: info@carmanah.com Web: www.carmanah.com